Biometrics for Terrorist Watch List Applications

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Biometrics for Terrorist Watch List Applications

Biometrics at the Borders

- Media attention since 9/11/2001
- Would it really work?
- How effective would it be?
- First-level analysis to help determine feasibility

Biometrics for Terrorist Watch List Applications

Biometric Types

- **Must have database of biometric samples from known terrorists**
- **Only face recognition and fingerprint included in NIST accuracy studies for Patriot and Enhanced Border Security acts due to available samples**
- **Only face recognition has published evaluation results for watch list task**

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US Border Statistics, FY 2001 (Source: GAO)

- **505,916,147 primary inspections at 395 Land, Sea, and Air POEs**
- **~1.7% sent to secondary inspection**
- **~8% in secondary denied entry to US (~0.1% of total)**

Biometrics for Terrorist Watch List Applications

Biometric Tasks

- **Verification – Are you who you say you are?**
- **Identification – I know you are in the database, can I find you?**
- **Watch List – Is this person in the database? If so, who is it?**

Biometrics for Terrorist Watch List Applications

Biometric Tasks

- **Watch list task is more difficult than verification and identification**
- **Watch list evaluation results only recently published**
- **In the past, identification task has been used to estimate watch list performance**
- **Actual watch list performance lower**

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Watch List Task

- **Individual is presented to system with no claim of identity**
- **Individual's biometric signature compared to all signatures in database and ranked by similarity**
- **Alarm generated if any score above threshold**
- **Top ranked signature in database is system's best guess at identity of individual**

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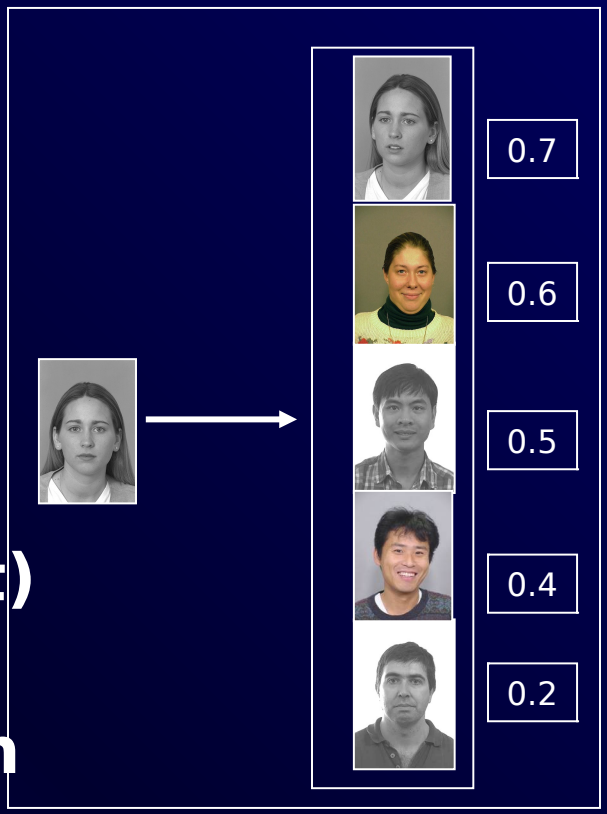
Watch List Task:
Person in database

Threshold = 0.65:
Alarm generated (correct)

Threshold = 0.75:
Alarm not generated (incorrect)

<u>Metric</u>: Probability of Detection and Correct Identification



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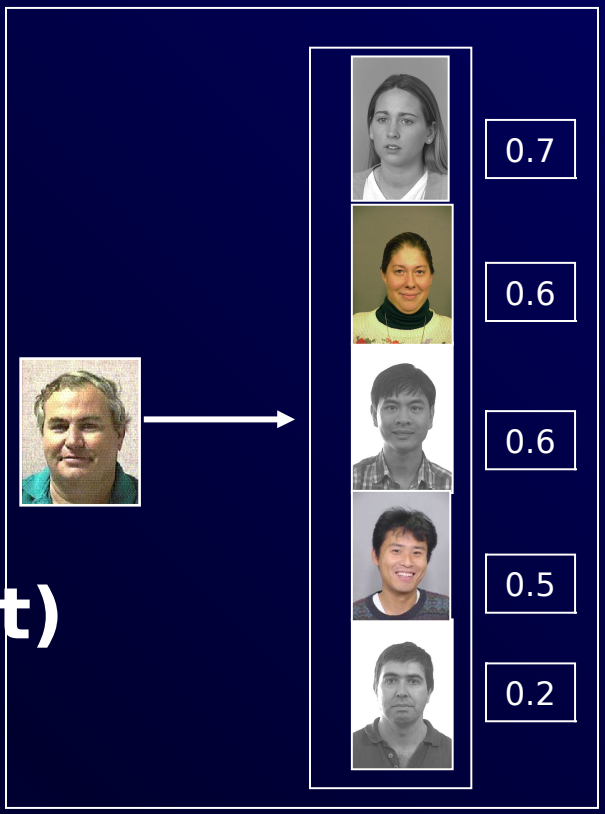
Watch List Task:
Person NOT in database

Threshold = 0.65:
Alarm generated (incorrect)

Threshold = 0.75:
Alarm not generated (correct)

<u>Metric</u>: Probability of False Alarm



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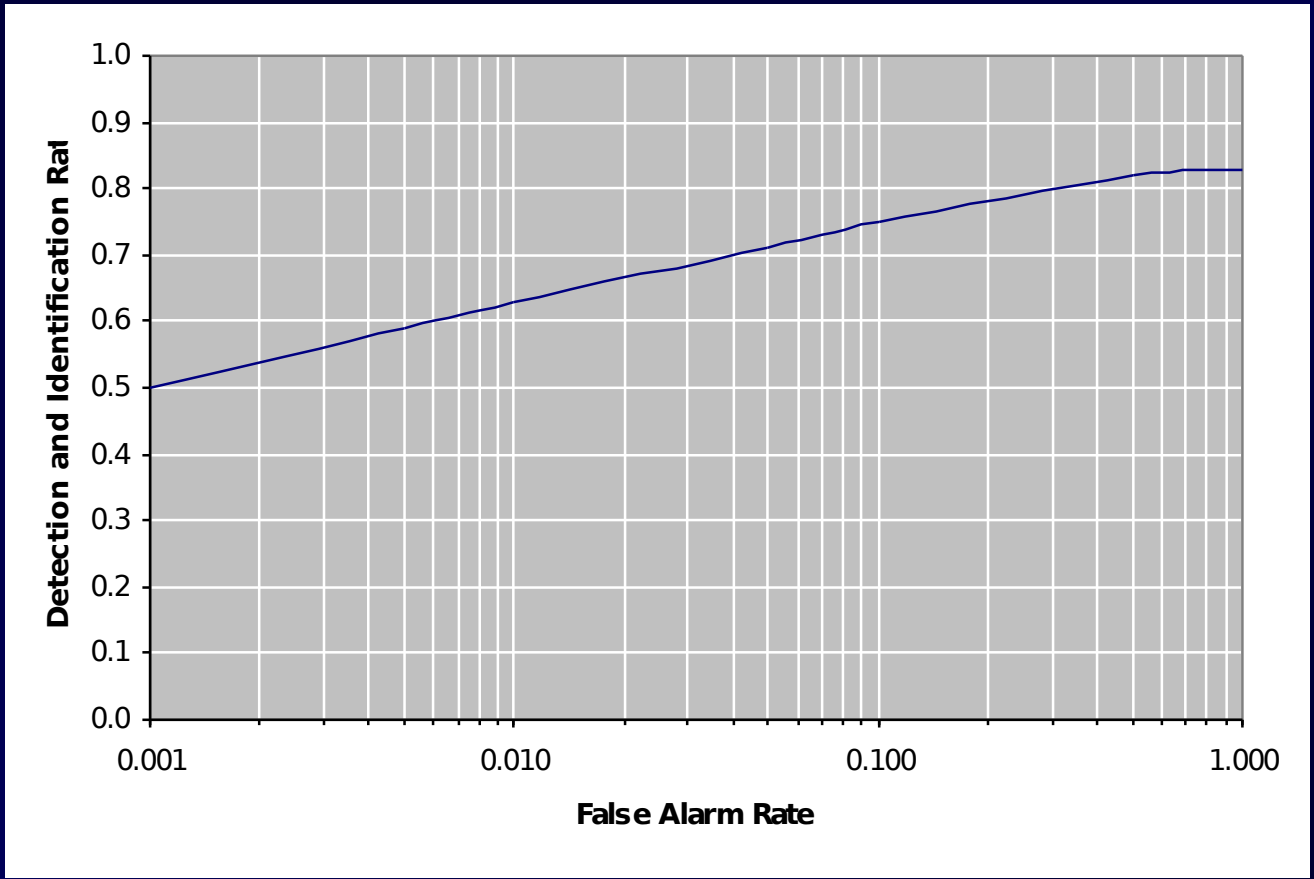
Plotting “Probability of Detection and Correct ID” vs. “Probability of False Alarm” for varying threshold values gives Watch List Receiver Operating Characteristic (ROC)

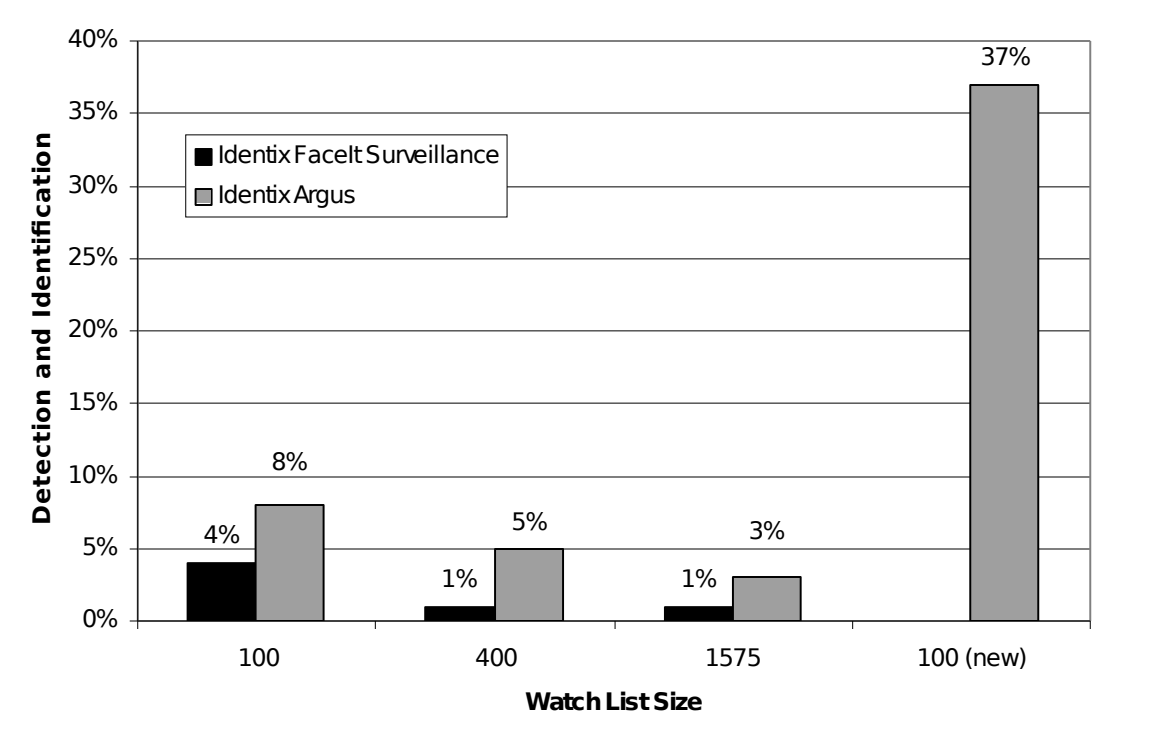


Recent Face Recognition Results

- **Face Recognition at a Chokepoint Scenario Evaluation**
  - **Four databases:**
    - **Size 100, 400, and 1575: existing badge images, non-uniform lighting, 505-1580 days time difference (top row)**
    - **Size 100: new images collected with uniform lighting, 0-38 [illegible] bottom row)**

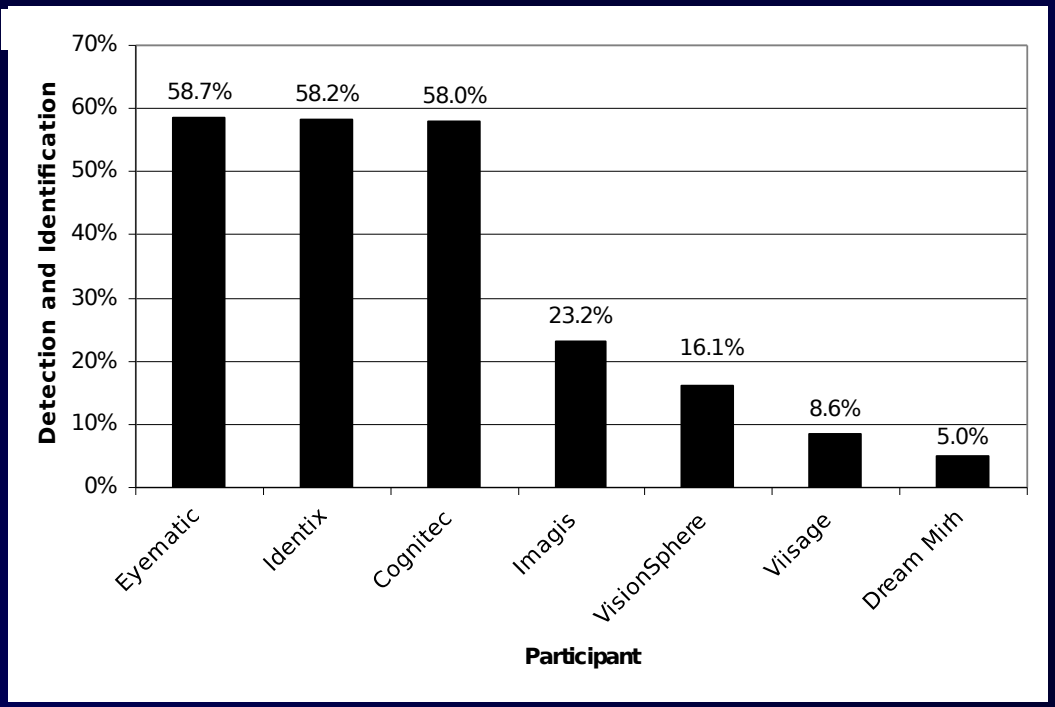
Recent Face Recognition Results

- **Face Recognition at a Chokepoint Scenario Evaluation**
  - **Wat[illegible]e (FAR)**



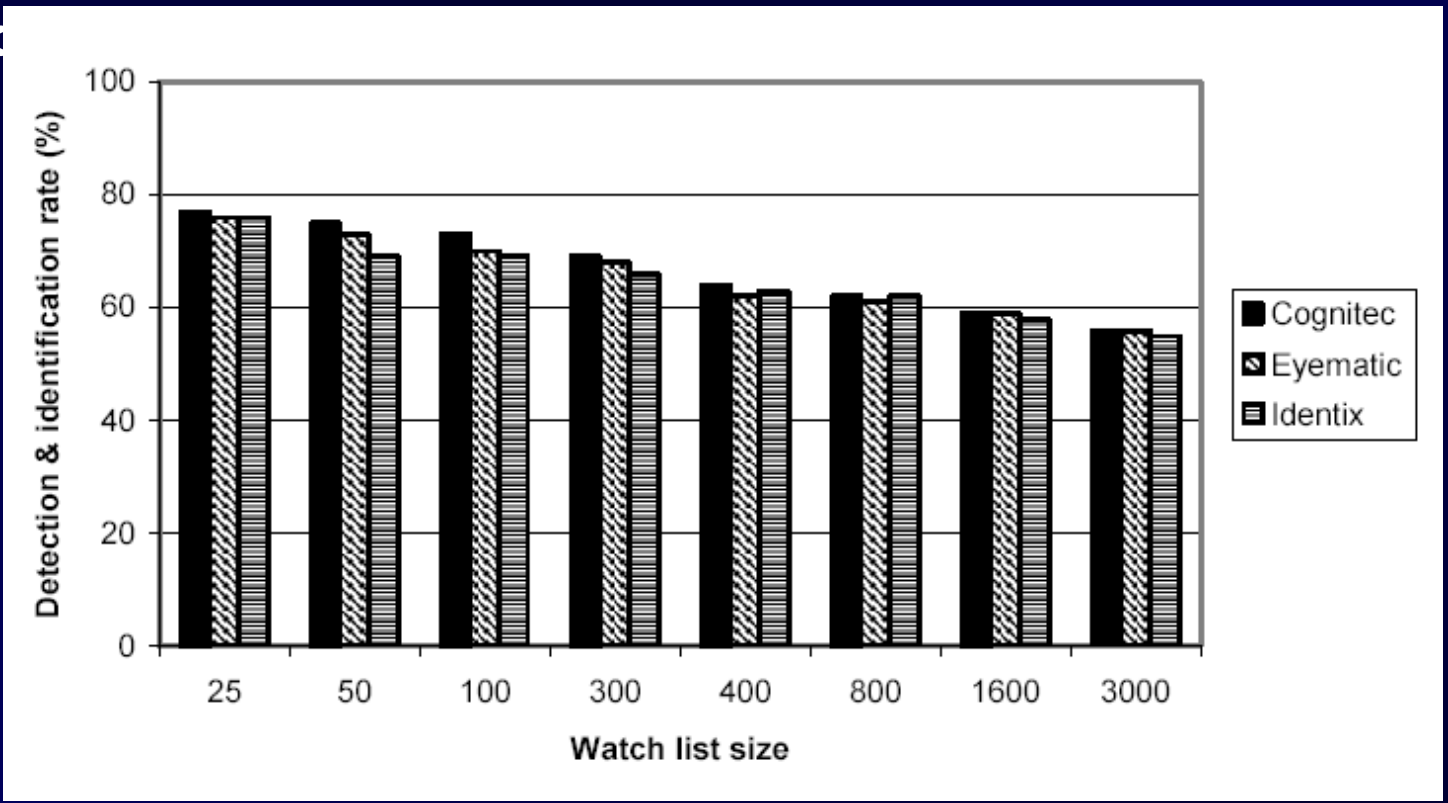
Recent Face Recognition Results

- **Face Recognition Vendor Test (FRVT) 2002**
  - **Images from State Department's Mexican Visa Applicant Files**
  - **Watch [illegible] size 800**



Recent Face Recognition Results

- **Face Recognition Vendor Test (FRVT) 2002**
  - **Watch list results for 1% FAR for different c**



Recent Face Recognition Results

- **Face Recognition Vendor Test (FRVT) 2002**
  - **Performance decreases approx. linearly with elapsed time**
  - **Better systems not sensitive to normal indoor lighting changes**
  - **Recognition from video sequences not better than still images**
  - **Males are easier to recognize than females**
  - **Younger people are harder to recognize than older people**
  - **Outdoor face recognition performance needs improvement**
  - **For identification and watch list tasks, performance decreases linearly in the logarithm of the database size**

Biometrics for Terrorist Watch List Applications

Case Study: Border Application

- Face recognition watch list task
- Assume Border Agents could handle 0.5% FAR
- Database size unknown at this time
- No particular demographic pattern expected
- Variable lighting conditions
- Overt operation
- Mostly cooperative users
- Enrollment/recognition time difference not known
- Required throughput of ~15 seconds per individual
- Current accuracy: 1.6% FAR (sent to secondary then allowed entry)

Case Study: Border Application

Assumptions

- Operator controls traffic flow and instructs users
- Users must remove hats and dark glasses
- Neutral facial expression
- Operator views match results to make final decision
- Not a replacement for human monitoring
- Tool to help determine who needs further scrutiny

Case Study: Border Application

Expected results from face recognition evaluations

- **Chokepoint Evaluation: 37% detect and identify rate**
  - **0.5% FAR, 100-person database**
  - **Older technology**
  - **Extract images from video in real-time, may not find good image**
- **FRVT 2002: 58.7% detect and identify rate**
  - **0.5% FAR, 800-person database**
  - **More advanced technology**
  - **Preselected still images of good quality**
- **Results not absolute – depend on good quality watch list images, good collection conditions, and other factors**

Case Study: Border Application

Conclusions

- Today's face recognition systems could improve chance of detecting and identifying individuals on watch list
- Degree of assistance is still an open question
- Humans not very good at face recognition verification task with unfamiliar individuals
- Watch list task more difficult than verification, so automated face recognition may be better than humans
- Further scenario and operational evaluations needed for detailed performance estimates
- Technology has improved with each evaluation

Case Study: Border Application

Other Issues

- How would existing networks handle screening everyone entering the country?
- What is the public perception of this use of technology?
- How much of a deterrent effect does the technology produce?
- How does automated face recognition performance compare with humans for the watch list task?

Biometric Web Sites

- www.dodcounterdrug.com/facialrecognition
- www.frvt.org
- www.biometricscatalog.org